# Thermodynamics of hydration of MX80 smectite derived from hydration isotherms

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# Thermodynamics of hydration of MX80 smectite derived from hydration isotherms

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Hydration energies contribute significantly to the stability of hydrated clay minerals. However, thermodynamic data of hydration for clay minerals are still poorly known. The present study aims to improve our comprehension of the hydration processes of sodic smectite MX80, and to implement a new methodology for extracting thermodynamic data of hydration of the smectite.

A first approach consists in applying a global hydration model to extract the thermodynamic data of total adsorbed water (G, H and S) from adsorption/desorption isotherms at 25°C and 45°C. The results are in good agreement with calorimetric data at 84 and 91% RH, from [1]. As capillary water, which is present in the intergranular porosity of the clay sample, does not contribute to the thermodynamic stability of the hydrated clay mineral, a refined calculation method has then been implemented to discriminate hydration water from capillary water in the total adsorbed water. The so called “hydration water” refers to interlayer water and surface recovering water of the smectite. Contrary to capillary water, the amount of hydration water depends on the nature of the smectite (nature of interlayer cations, layer charge and location of the charge). The thermodynamic properties of capillary water are calculated after [2]. The present method allows (i) to estimate the respective amounts of hydration and capillary waters and (ii) calculate the energies of formation of the hydration water.

This work is to be extended to other hydrated clay minerals in order to refine the solid solution model from [3] and to finally provide a global predictive model for clay mineral hydration energies.

[1] Gailhanou et al. (2012) GCA **89**, 279-301. [2] Lassin et al. (2005) GCA **69**, 5187-5201. [3] Vieillard et al. (2011). GCA **75**, 5664-5685.